Topics1

Saturday, January 30, 2021 9:42 PM

Capstone Project ; Question : What to do when design an AI project?

Data .

images: X.
label : Y.

Lab Procedure:

Given X, Y → We are searching for f(·). → Error Measure : There is a loss function $\frac{1}{n}\sum_{i=1}^{n}(\hat{Y}_i - Y)^2$.

Here f(·) is a function.

It maps from X to Y. i.e. $f: X \to Y$.

this function is called "squared loss"

it measures square distance for all the observation (i.e. if there are n observation, we add all n terms together)

Production

now we have new image. another X

We find f(·)

X → We can use f(·) → Generate a prediction $\hat{Y} = f(X)$

- event
- sample space
- permutation / combination

ex: coin toss

Coin toss:  Possible outcome : {Head, Tail}
H T

setup

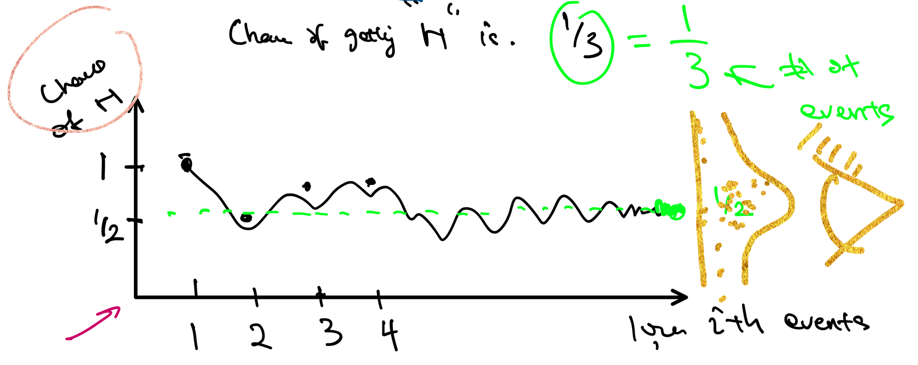
assume: coin landed.

sample space : {H, T}

Assumption : each experiment is independent

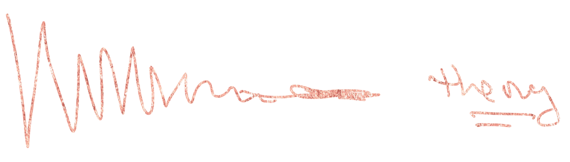
1st.	2nd	3rd	4th	5th	6th	...	10,000 th
H	T	H	H	T	T	...	T
Chance of H: 1/1	1/2	2/3	3/4	3/5	3/6		

Ex: Toss a fair coin 3 times
I get {H, T, T}.
Chance of getting "H" is. $1/3 = \frac{1}{3}$ ← # of H; ← # of events



"CLT": Central Limit Theorem.

① LLN : Random variable : mean = 50%
experiment many times sample mean will be close to theoretically mean 50%.



② CLT : Random variable (X) with mean μ (mu)
variance σ^2 (sigma sq.)
$\bar{X}$: sample mean

$\sqrt{n}(\bar{X} - \mu) \sim N(0, \sigma^2)$

Scaling factor that is depended on sample size; sample mean; theoretical mean; variance

$N(-\ -)$ normal distribution

Some Basic Counting:

How to count numbers?

There are 3 stocks available to investors.
They are Apple, Facebook, Amazon.
Their tickers are AAPL, FB, AMZN.

You are a money manager.

If you don't impose any restrictions to your strategy you have 3! possible choices.

Math: $3! = 3 \times 2 \times 1 = 6$! : factorial

Portfolio has 3 spots. : 1st ___ 2nd ___ 3rd ___

The 1st can be any three of the stocks.

AAPL, FB, AMZN.

If you choose AAPL, then you are left with FB, AMZN.
This means you have 2 choices.

FB, AMZN.

If you choose AMZN, then you are left with FB,

Permutation How many arrangement you can make if you are picking stock one by one?
You can start with AAPL then you talk about FB, last AMZN.
Or you can go with this order AAPL AMZN, FB.
⋮

This concept is called permutation.
$\frac{n!}{(n-r)!} = \frac{3!}{(3-3)!} = \frac{3\times2\times1}{0!} = 3\times2\times1 = \boxed{6}$ $1! = 0! = 1$ ← definition

For 3 stocks ; Stock 1, Stock 2, Stock 3, Say you want to arrange 3.
You do. 123 213 312
132. 231. 321

In total it's $\boxed{6}$.

Combination Among three stocks, you only want to choose 2.

There are the following possible ways. 1, 2, 3

① AAPL. FB ③ FB. AMZN.
② AAPL. AMZN.

① (12)
② (13) (3)
③ (23)

In total there are $\boxed{3}$ ways!

Math: $\binom{3}{2} = \frac{3!}{2!\,1!} = \frac{3\times2\times1}{2\times1} = \boxed{3}$ $\binom{n}{k} = \frac{n!}{k!(n-k)!}$

this reads "3 choose 2"

Bayes' Theorem

Given events A, B. their probability is $\mathbb{P}(A), \mathbb{P}(B)$
Joint Probability : $\mathbb{P}(A \cap B)$.
Probability of A given B. $\mathbb{P}(A|B)$
Probability of B given A. $\mathbb{P}(B|A)$.

Definition : $\mathbb{P}(A|B) = \frac{\mathbb{P}(A\cap B)}{\mathbb{P}(B)}$ Prob. of. A and B; Prob. of. B

A given B; A conditioning on B

Define: $\mathbb{P}(B|A) = \frac{\mathbb{P}(A\cap B)}{\mathbb{P}(A)} \Rightarrow \mathbb{P}(B|A)\cdot\mathbb{P}(A) = \mathbb{P}(A\cap B)$

ex: $0.5 = \frac{0.4}{0.8} \Rightarrow 0.5 \times 0.8 = 0.4$

Thus, this means $\boxed{\mathbb{P}(A|B) = \frac{\mathbb{P}(B|A)\cdot\mathbb{P}(A)}{\mathbb{P}(B)}}$ ☆ ← Bayesian Neural Network ← algorithm

θ y

Poster → $\mathbb{P}(\theta|Y) = \frac{\mathbb{P}(Y|\theta)\cdot\mathbb{P}(\theta)}{\mathbb{P}(Y)}$ ← Prior

parameter; obs.

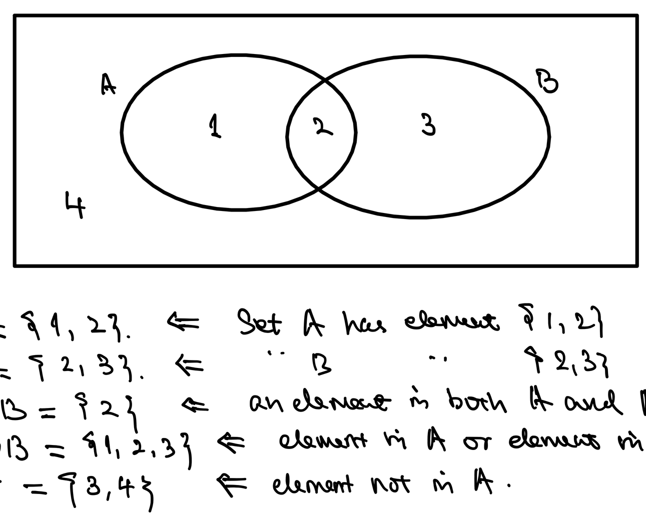
"set rules"

→ What are the rules Before?

→ What are the rules ?

Venn Diagram.

Suppose there is set $A = \{1,2\}$. $B = \{2,3\}$.
in sample space $S = \{1,2,3,4\}$.
Then Venn Diagram is.



$A = \{1,2\}$. ⇐ Set A has element {1, 2}
$B = \{2,3\}$. ⇐ " B " {2,3}
$A \cap B = \{2\}$ ⇐ an element in both A and B.
$A \cup B = \{1,2,3\}$ ⇐ element in A or element in B.
$A^c = \{3,4\}$ ⇐ element not in A.

law of Total Probability:

$\mathbb{P}(S) = \mathbb{P}(A) + \mathbb{P}(B) - \mathbb{P}(A\cap B)$.

"NULL" empty value

If A and B are independent, that means $\mathbb{P}(A\cap B) = \emptyset$.

Then $\mathbb{P}(S) = \mathbb{P}(A) + \mathbb{P}(B)$.

There is no intersection.

Venn Diagram: